

REMARKS

Claims 15-24 and 35-41 are pending in the application.

Claims 15, 17-22, 35-37 and 39-41 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Sharan, U.S. Patent No. 5,747,116 in view of Taguwa, U.S. Patent No. 6,020,254. The Examiner is reminded by direction to MPEP § 2143 that a proper obviousness rejection has the following three requirements: 1) there must be some suggestion or motivation to modify or combine reference teachings; 2) there must be a reasonable expectation of success; and 3) the combined references must teach or suggest all of the claim limitations. Claims 15, 17-22, 35-37 and 39-41 are allowable over the combination of Sharan and Taguwa for at least the reason that the references, either individually or as combined, fail to disclose or suggest each and every limitation in any of those claims.

Independent claim 15 recites forming a masking layer, patterning the masking layer to form openings, and first etching a material beneath the masking layer through the openings to expose a silicon material at a base of the opening. Claim 15 further recites after the etching, removing the masking layer and, after the removing and before subsequently depositing any material over the substrate, plasma etching the substrate. As noted by the Examiner at page 2 of the present action, Sharan does not teach or suggest the recited forming a masking layer over a substrate. Additionally, Sharan does not teach or suggest the claim 15 recited patterning a masking layer, the recited etching a material beneath a

masking layer through openings in the masking layer, or the recited subsequent removal of the masking layer.

The Examiner relies on the Taguwa disclosure to support the 103(a) rejection of independent claim 15 based upon the Taguwa disclosure at column 5, lines 25-59 which discloses formation of a contact hole using "conventional lithography and dry etching". The Examiner is reminded by direction to MPEP § 2143.03 that when determining obviousness the claim must be considered as a whole. All limitations must be taught or suggested by the references with every word of the claim being considered. The general disclosure of formation of a contact hole using conventional lithography as disclosed in Taguwa does not disclose or suggest the claim 15 recited patterning a masking layer to form openings therein, the recited etching a material beneath a masking layer to outwardly expose a silicon material at the base of the opening, the recited removing the masking layer after the etching or the recited plasma etching the substrate after removing the masking layer and before subsequently depositing any material over the substrate. As combined, Sharan and Taguwa fail to disclose or suggest each and every limitation of independent claim 15 when such claim is considered as a whole with every word of the claim being considered. Accordingly, independent claim 15 is not rendered obvious by Sharan in view of Taguwa and is allowable over these references.

Dependent claims 17-22 are allowable over the combination of Sharan and Taguwa for at least the reason that they depend from allowable base claim 15.

With respect to independent claim 35, such recites forming a photoresist layer, patterning the photoresist layer to form openings therethrough, dry etching

a layer immediately beneath the photoresist through the openings to expose a substrate material comprising silicon at a base surface of the openings. Claim 35 further recites forming a carbon-containing polymer residue over the silicon material at the base of the opening during the dry etching, removing the photoresist after the dry etching and before subsequently depositing any material over the substrate, and plasma etching the carbon-containing polymer residue from the substrate. As discussed above, Sharan fails to disclose or suggest the recited forming a photoresist layer, the recited patterning a photoresist layer, the recited etching a first layer through openings in the photoresist layer and the recited subsequent removal of the photoresist layer followed by plasma etching.

As further discussed above, Taguwa discloses generally a utilization of conventional photolithography to form contact openings. Taguwa does not disclose or suggest the recited forming a photoresist layer, the recited patterning a photoresist layer to form openings, the recited dry etching a first layer immediately beneath the photoresist layer through the openings, the recited removal of photoresist layer after the dry etching followed by plasma etching of a carbon-containing polymer residue prior to depositing any material over the substrate. As combined, Sharan and Taguwa fail to disclose or suggest each and every limitation of independent claim 35. Accordingly, independent claim 35 is not rendered obvious by the combination of Sharan and Taguwa and is allowable over these references.

Dependent claims 36-37 and 39-41 are allowable over the combination of Sharan and Taguwa for at least the reason that they depend from allowable base claim 35.

Claims 16, 23-24 and 38 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Sharan in view of Taguwa and in further view of Stinnett, U.S. Patent No. 6,325,861. As discussed above independent claims 15 and 35 are not rendered obvious by the combination of Taguwa and Sharan. Stinnett discloses utilizing a patterned resist to form contact openings to a metal layer 16 (col. 3, ll. 32-37), followed by sequential removal of etchant residue 10 from opening sidewalls 24 and removal of remnant resist from the substrate (col. 6, ll. 37-39 and col. 8, ll. 31-37). Stinnett does not disclose or suggest the claims 15 and 35 recited etching to expose a silicon material at a base of an opening or the recited removal of a masking layer or photoresist from the substrate followed by plasma etching the substrate. As combined, Sharan, Taguwa and Stinnett fail to disclose or suggest the claims 35 and 15 recited etching to expose a silicon-comprising material at a base of an opening and subsequently removing a masking layer or photoresist followed by plasma etching. Accordingly, independent claims 15 and 35 are allowable over the cited combination of Sharan, Taguwa and Stinnett. Dependent claims 16, 23-24 and 38 are allowable over the cited combination of Sharan, Taguwa and Stinnett for at least the reason that they depend from corresponding allowable base claims 15 and 35.

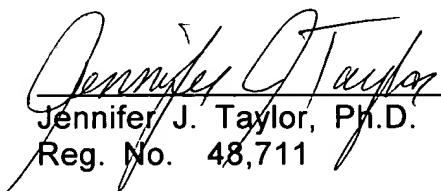
For the reasons discussed above, claims 15-24 and 35-41 are allowable. Accordingly, applicant respectfully requests formal allowance of claims 15-24 and 35-41 in the Examiner's next action.

The abstract is objected to based upon excessive length. The abstract is amended to comply with the 150 word length limitation. Accordingly, applicant requests withdrawal of the objection to the abstract in the Examiner's next action.

Respectfully submitted,

Dated:

October 8, 2002 By:


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Appl. N . 09/360,292



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Application Serial No. 09/360,292
Filing Date July 22, 1999
Inventor Sharan et al.
Assignee Micron Technology, Inc.
Group Art Unit 1765
Examiner Shamim Ahmed
Attorney's Docket No. MI22-1106
Title: Plasma Etching Process

VERSION WITH MARKINGS TO SHOW CHANGES MADE ACCOMPANYING
RESPONSE TO JULY 8, 2002 FINAL OFFICE ACTION

In the Specification

The replacement specification paragraphs incorporate the following amendments. Underlines indicate insertions and ~~strikeouts~~ indicate deletions.

The abstract has been amended as follows:

In one implementation, a plasma etching process includes ~~forming a carbon containing material over a semiconductor substrate. The etching a carbon containing material is plasma etched from the a substrate at a temperature of at least 400°C using a hydrogen or oxygen containing plasma.~~ In one implementation, a plasma etching process includes forming openings in a masking layer over a substrate, etching through a material beneath the masking layer through the openings and removing the masking layer. ~~The masking layer is patterned to form openings therein. Material beneath the masking layer is etched through the openings. After such etching, the masking layer is removed from the substrate. After such removing and before subsequently depositing any material over the substrate, the~~ The substrate is then plasma etched at a

temperature of at least 400°C. In one implementation, a semiconductor plasma etching process includes ~~first etching material from a substrate and~~ forming an undesired residue at least partially over the substrate during a ~~the~~ first etching. ~~After the first etching and before subsequently depositing any material over the substrate,~~ plasma etching the undesired residue is ~~plasma etched~~ from the substrate. In one implementation, a ~~chemical vapor deposition~~ process of depositing a material over a semiconductor substrate includes ~~positioning a semiconductor substrate within a plasma enhanced chemical vapor deposition reactor.~~ The plasma etching a substrate is ~~plasma etched~~ within the a reactor using a first gas chemistry. ~~After the plasma etching,~~ and depositing a material is ~~chemical vapor deposited~~ over the semiconductor substrate within the reactor using a second gas chemistry without removing the substrate from the reactor ~~between the etching and the depositing.~~

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